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GB 04/5111

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   P104302GB

2. Patent application number
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   17 DEC 2003 0329205.9

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*
   Morton GRAHAM
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   Westhoughton
   BOLTON
   Lancashire BL5 2RY

   Patents ADP number *(if you know it)*
   7856255001

   If the applicant is a corporate body, give the country/state of its incorporation
   UNITED KINGDOM

4. Title of the invention
   AN ILLUMINATION DEVICE

5. Name of your agent *(if you have one)*
   HARRISON GODDARD FOOTE

   "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*
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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

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11. I/We request the grant of a patent on the basis of this application.

Signature: Harrison Goddard Foote — Date: 16/12/2003

12. Name and daytime telephone number of person to contact in the United Kingdom: MIKE AJELLO — 0161 427 7005

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P104302GB

AN ILLUMINATION DEVICE

THIS INVENTION concerns illumination devices which may be used for highlighting an object such as a building for aesthetic or advertising purposes or for providing illuminated signs. Conventional products for these purposes such as neon or fluorescent lighting require considerable electrical power in operation and in the case of neon lighting a high voltage is required often in the region of several Kilovolts of electricity which has implications both for safety and economy. Furthermore, such products tend to be inefficient in the distribution of light resulting in highlights and dim spots giving an aesthetically unattractive appearance.

An object of the present invention is to provide an illumination device providing substantially uniform light output with minimal power consumption.

According to the present invention there is provided an illumination device comprising a first elongate translucent member, an LED light source located at least at one end or edge of the member to pass light into and along the member, a second translucent member arranged in superimposed relationship with the first translucent member thus to define a

gas space therebetween; characterised by a surface formation on the first translucent member causing it, in use, to function as a leaky wave guide allowing light to escape into the gas space for secondary diffusion therein, the second translucent member thus being adapted to pass the secondarily diffused light externally thereof.

The first translucent member may be a rod, and the second translucent member a tube surrounding the rod and defining the gas space therebetween.

The rod may have an undulating surface.

The rod may be of circular cross-section.

The rod may be of elliptical cross-section.

The LED light source may comprise separate light sources disposed at opposite ends respectively of the rod.

A reflector may be disposed on a part of the surface of the first translucent member within the gas space.

The first translucent member may be of an acrylic or polycarbonate material.

The second translucent member may be of an acrylic or polycarbonate material.

Support means may be provided in the gas space to maintain a predetermined spacial relationship between the first and second translucent members.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying schematic drawings, in which:-

Fig. 1 is a transverse cross-sectional view of an illumination device made in accordance with the invention;

Fig. 2 is a side elevation of a part of the illumination device of Fig. 1;

Fig. 3 is a schematic side elevation of the device of Fig. 1;

and Fig. 4 is a view similar to Fig. 1 illustrating an additional but optional feature.

It is known that if light is transmitted into a translucent rod, for example of an acrylic or polycarbonate material, having substantially total internal reflection, the light is transmitted down the length of the rod but is invisible when viewed externally. Any imperfections in the surface of the rod will allow light to escape but at a very shallow angle with respect to the surface of the rod. If the imperfection is in the form of a scratch then the light will tend to be transmitted almost perpendicular to the surface of the rod.

The illumination device to be described utilises a rod of such a material but wherein the surface imperfection is predetermined such as to permit light to escape from the surface of the rod to a controlled degree as will be described.

Referring now to the drawings, the illumination device comprises an acrylic or polycarbonate rod 10 which has a wavy or undulating surface as shown, in exaggerated form, in Fig. 2. Thus, when light is injected into the end of the rod as will be described, the rod behaves as a leaky wave guide allowing light to escape from its surface at a very shallow angle.

The rod is of circular cross-section and is concentrically disposed within an outer translucent cover 11which is of sufficiently larger diameter than the rod 10 to define, between them, a gas space 12. The cover 11 may be of an acrylic or polycarbonate material.

The rod 10 is provided with a predetermined undulating surface illustrated in exaggerated form at 13 in Fig. 2. The effect of the undulating surface is to allow light to escape from the rod but at a very shallow angle to the surface since there is no sharp disruption to the surface. Within the gas space 12 the leaked light is secondarily diffused and in effect mixed to a uniform distribution of light within the space. The tube 11 then captures this light and transmits it outwardly transverse to the axis of the device to provide a visually uniform light along the length of the device. This light is then visible from any angle with respect to the outer surface of the tube 11 thus to give the overall impression of the uniformly illuminated rod.

As shown in Fig. 1, the rod 10 is supported within the tube 11 by spaced ribs 16 which may be integrally formed with the tube and maintain a uniform gap between the tube and

the rod. Thus, with the rod supported concentrically within the tube, lamp units illustrated at 14 in Fig. 3 are sealingly applied to the ends of the rod and tube respectively, the units 14 enclosing an array of LED's which thus project light into the rod 10.

An illumination device of this kind affords a considerable saving in electrical energy when compared with conventional systems. Typically, neon lighting requires 23 watts of electricity per metre and even an efficient LED system would utilise perhaps 6 watts per metre. The increase in efficiency in distributing the light using the concept of a leaky wave guide within a tube with a gas space between them provides a system which may be operated at around 1 watt per metre with equivalent light output.

The gas space is preferably filled with air thus avoiding the potentially harmful properties of phosphors and the like such as are used in neon and fluorescent tubes. The LED lighting units 14 may be supplied with low voltage power in the region of 10 volts thus further increasing the safety aspects of the present invention.

Referring now to fig. 4, in an alternative embodiment there is provided a reflective strip 15 passing along the length of the leaky wave guide or rod 10 and in surface contact therewith so as to concentrate the light primarily in one direction whilst still creating uniformly distributed light within an angle generated by the width of the reflector strip 15. This may serve to prevent so-called light pollution by illuminating only the surrounding area required to be illuminated. For example, if an illumination device of this kind is mounted on the wall of a building, the light is seen when approaching the building but does not illuminate the wall itself. By careful selection of the position of the reflector 15, the beam of visible light may be directed where specifically required.

If it is required to produce a line of light of several metres in length then several such illumination devices may be mounted end-to-end. Each LED lamp unit 14 may have a translucent cover so that in an assembly of several such devices in end-to-end alignment, there is substantially no loss of illumination between the devices thus giving the impression of a continuous line of light. This is particularly useful where devices of this kind are used to highlight architectural features such as the outline of a building or roof. Electrical connection to each device may be at one end of the device with conductors

passing along the device to the other end through the gas space 12.

Such devices may be used for advertising or for highlighting, by illumination, areas or equipment for safety and to increase visibility from a distance. Another use for the device is for the illumination of rooms or corridors within buildings with low levels of light, typically as may be required for emergency lighting and may be used to provide energy savings where high levels of lighting are not required. However, it may be possible to introduce sufficient light energy into the device for it to serve as general ambient lighting and the illumination of a space.

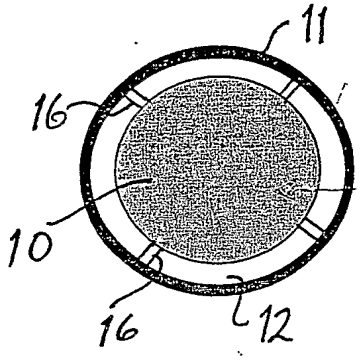

Fig. 1

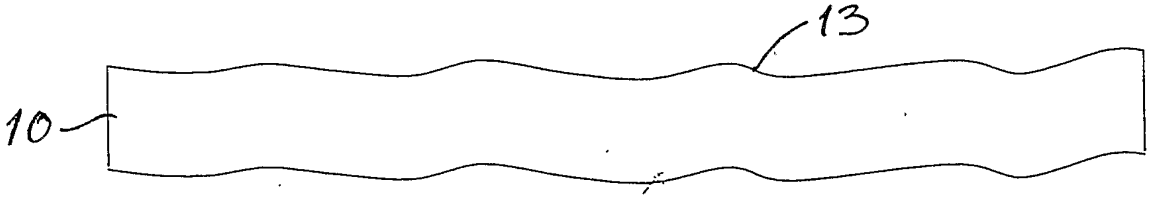

Fig. 2

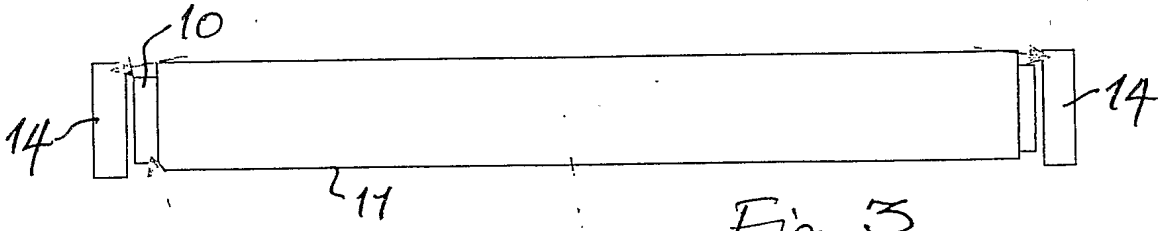

Fig. 3

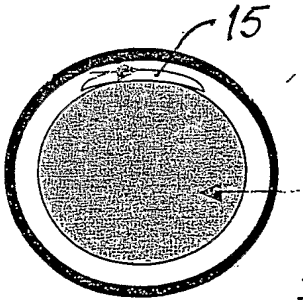

Fig. 4